

Draft Sampling Design for the Second Statewide Survey of Bioaccumulation on the California Coast The Bioaccumulation Oversight Group



Strategy for Phased Approach

- Three rounds (two by SWAMP)
- Phasing
 - 2018: Southern California Bight (SWAMP, Bight)
 - 2019: San Francisco Bay (RMP)
 - 2020: Central Coast and North Coast (SWAMP)

Coast Round 2.1 Timeline and Products

- BOG Review Panel Meeting - 02/06/18
- Distribute draft Sampling Plan Addendum - Feb 27
- Review comments on Plan due - Mar 13
- Finalized Sampling Plan - Mar 27
- Finalized QAPP - April
- Intercalibration evaluation - April
- Begin sampling - May
- Second intercalibration evaluation (if necessary) - June
- Begin chemical analysis - June
- Finish sampling - October
- **Cruise report** - January 31, 2019
- Complete dataset ready for internal BOG review - March 30, 2019
- Data validated and loaded by State Board - April 30, 2019
- BOG review of draft “data report” - June 2019
- Oral report to Bight - June 2019
- **2018 dataset publicly available** (put in CEDEN) - July 2019
- Draft technical report - July 2019
- **Final technical report** - September 2019

Coordination

Coordinated Efforts (2018)

- Bight '18 - contributing sampling of 2 zones, analysis of organics and arsenic in 145 samples (>\$200K)
- Region 4 - \$54K - more sharks and surfperch
- Region 8 - \$7K - general support

Coordinated Efforts (2019)

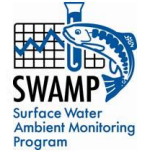
- SF Bay RMP - \$380K

Benefits

- Overall **\$640K** of matching funds
- Budgetary efficiencies
- Joint assessment across programs
- Multiple programs benefit from intercalibration

Sampling Design

- Largely a repeat of the 2009-2010 statewide survey



Final Monitoring Plan

2009

**Sampling and Analysis Plan for a Screening Study of
Bioaccumulation on the California Coast**

September 2008



www.waterboards.ca.gov/swamp

Management Questions For This Screening Study

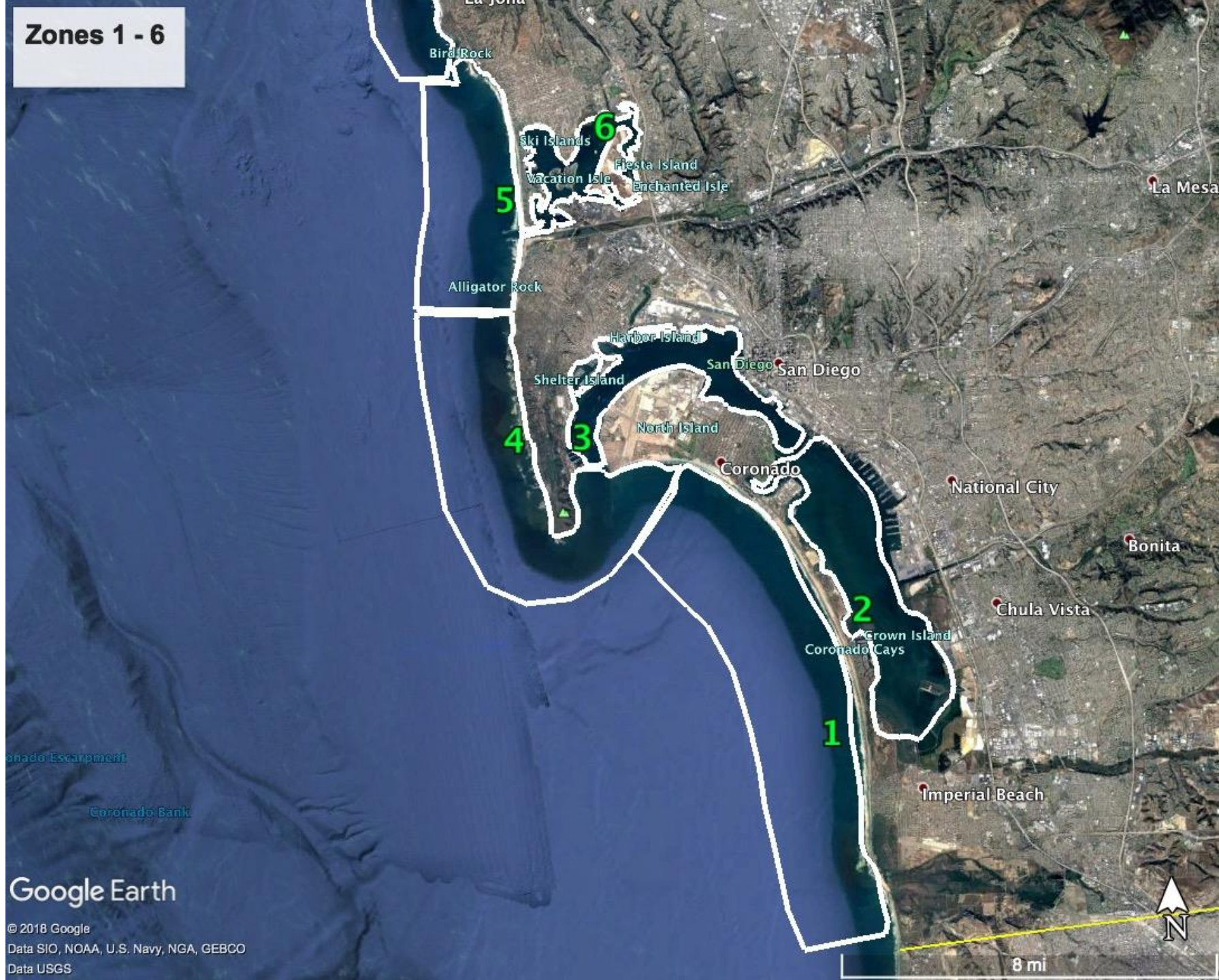
Original text in black Proposed revisions in blue
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1. Status of the Fishing Beneficial Use
 - (OLD) For popular fish species, what percentage of popular fishing areas have low enough concentrations of contaminants that fish can be safely consumed?
 - (PROPOSED NEW) What is the status of the fishing beneficial use in popular fishing areas in regard to contaminants?
2. Regional Distribution
 - What is the regional distribution of contaminant concentrations in fish?
3. Need for Further Sampling
 - Should additional sampling of bioaccumulation in sport fish (e.g., more species or larger sample size) in an area be conducted for the purpose of developing more comprehensive consumption guidelines?

Spatial Units: Fishing Zones

- Established for the entire coast in the first survey
- Considerations for delineating zones
 - Fishing pressure
 - Even distribution across coast
 - Larger zones in less populated areas
 - Homogeneity of land use, contamination
 - Stakeholder interest
- 68 zones for the state
 - 27 in SC Bight
 - Intensified subzone sampling in 1 zone
 - 6 in SF Bay
- Nearshore (includes bays and estuaries)
 - Zone width guidelines
 - Depth not to exceed 200 m (rule)
 - mainly 60 m and less (guidance)

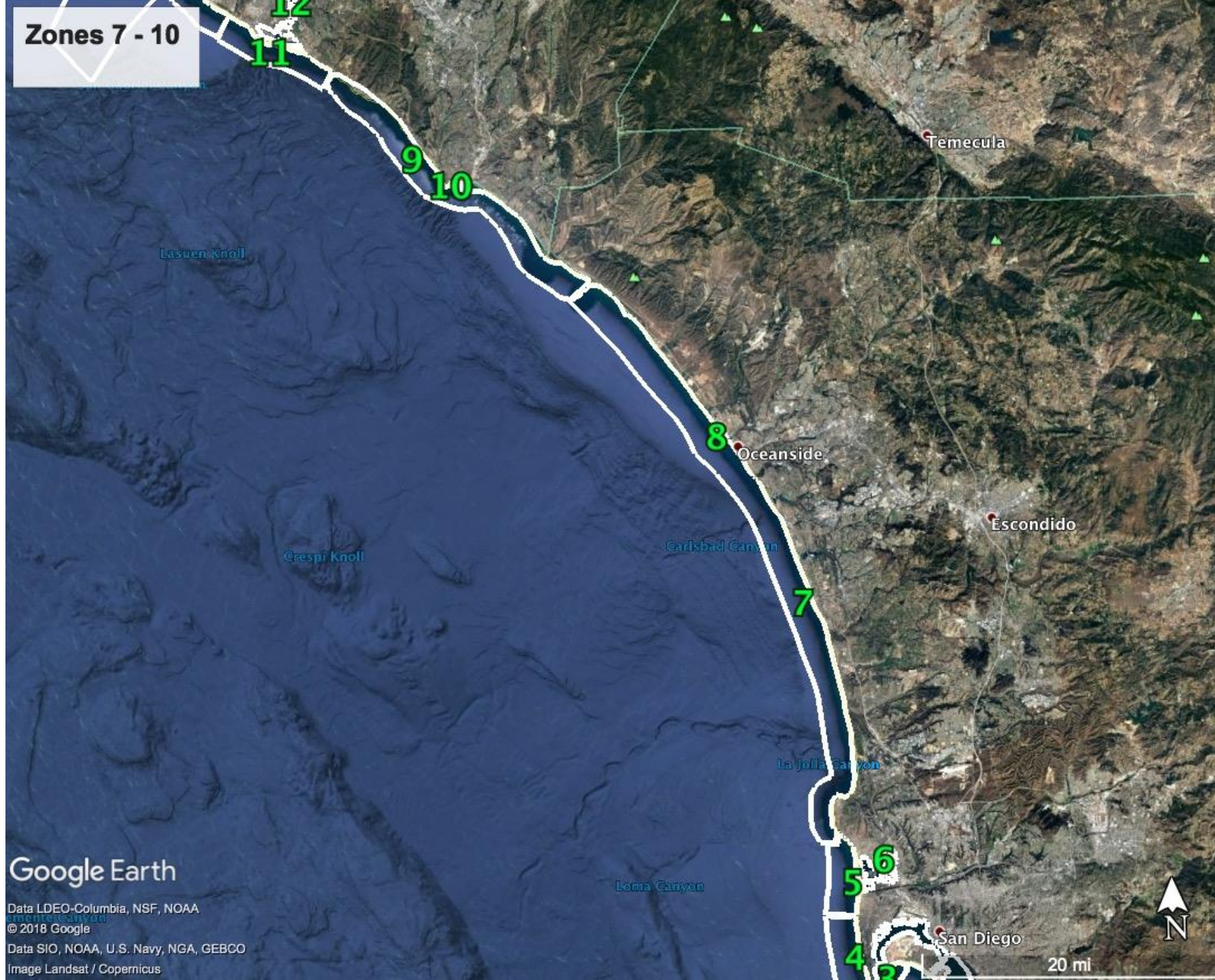
Zones 1 - 6



Google Earth

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Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data USGS

Zones 7 - 10



Google Earth

Data LDEO-Columbia, NSF, NOAA

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Image Landsat / Copernicus

Zones 11 - 21



Zones 22 - 27



Google Earth

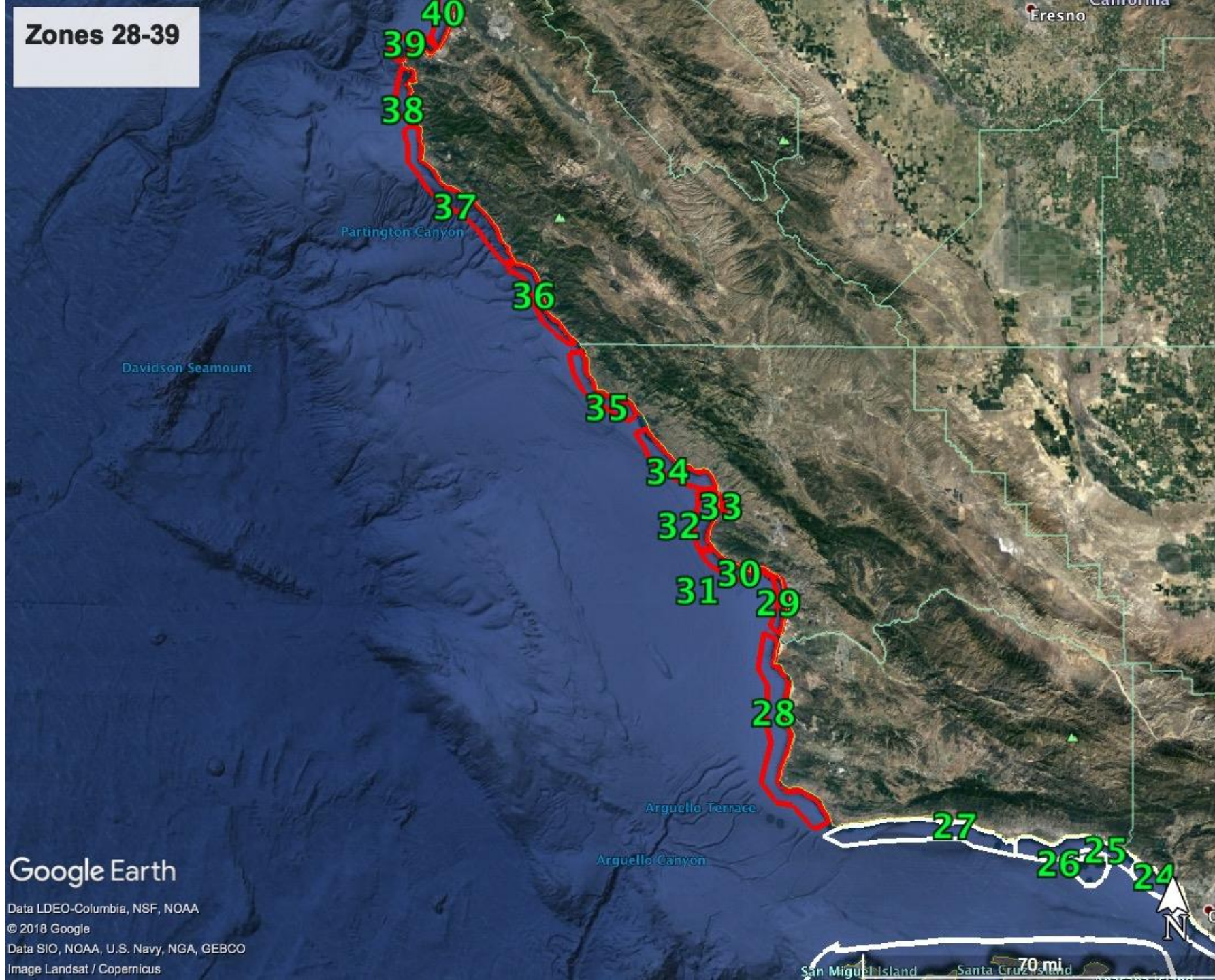
Data LDEO-Columbia, NSF, NOAA

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Image Landsat / Copernicus

Zones 28-39



Port of Los Angeles/Port of Long Beach

Lomita

Consolidated Slip

Long Beach

Pier J

White Island

15 Freeman Island

16

Port of Long Beach
Shallow Water Habitat

Cabrillo Pier

Smith Island

Mormon Island

Terminal Island

San Pedro

Google Earth

Data USGS

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Data CSUMB SFML, CA OPC



3 mi

Target Species

- 5 species per zone is default statewide plan
- Fish species that are (in order of priority):
 1. **Continuity with past sampling** (a big factor this time)
 2. Popular for consumption
 3. Sensitive indicators of problems - “bad boys” - for the different pollutants of concern - helps with evaluating safe consumption
 4. Widely distributed - spatial coverage and patterns
 5. Cleaner species
 6. Represent different exposure pathways (benthic vs pelagic)

Target Species

- Targets vary by region
- Primary targets and secondary targets

Target Species: 2009-2010

Coast <3m	SoCal	CenCal	NorCal
Primary	Rockfish: Kelp Bass	Rockfish: Blue	Rockfish: Black
			Lingcod
	Croaker: White	White Croaker	
		Salmon	Salmon
	Surfperch: Barred	Surfperch: Barred	Surfperch: Redtail
		Smelt: Jacksmelt	
			Rockfish: Blue
	Chub Mackerel		
Secondary		Lingcod	
		Smelt: Topsmelt	
	Rockfish: Barred Sandbass, Scorpionfish, Spotted Sandbass, Olive Rockfish	Rockfish: Black	
	Surfperch: Walleye	Surfperch: Shiner	Surfperch: Walleye
			Cabezon
	Croaker: Yellowfin		

Target Species: 2009-2010

Bays/ Harbors	SoCal	CenCal	NorCal
Primary	Surfperch: Barred	Surfperch: Shiner	Perch: Walleye
	Shark: Leopard	Shark: Leopard	Shark: spiny dogfish
	Croaker: White	White Croaker	
		Smelt: Jacksmelt	Smelt: Jacksmelt
		Flatfish: California Halibut	
	Rockfish: Kelp Bass		Rockfish: Black
			Surfperch: Shiner
	Chub Mackerel		
Secondary	Rockfish: Barred Sandbass, Scorpionfish, Spotted Sandbass, Olive Rockfish	Rockfish: Brown	Rockfish: Blue
			Lingcod
	Surfperch: Walleye	Surfperch: Black	
	Shark: Gray Smoothhound	Shark: Brown Smoothhound	Shark: smoothound
		Smelt: Topsmelt	Top or Jacksmelt
		Flatfish: RecFin XX	
	Croaker: Yellowfin		

Details and Decisions: Species

- **Bight Program preferences**
- **Primary**
 - White Croaker
 - Kelp Bass
 - Pacific Chub Mackerel
- **Secondary**
 - Barred Sand Bass
 - Spotted Sand Bass
 - Yellow Croaker
 - Olive Rockfish
 - Scorpionfish
 - Halibut
 - Shiner Perch

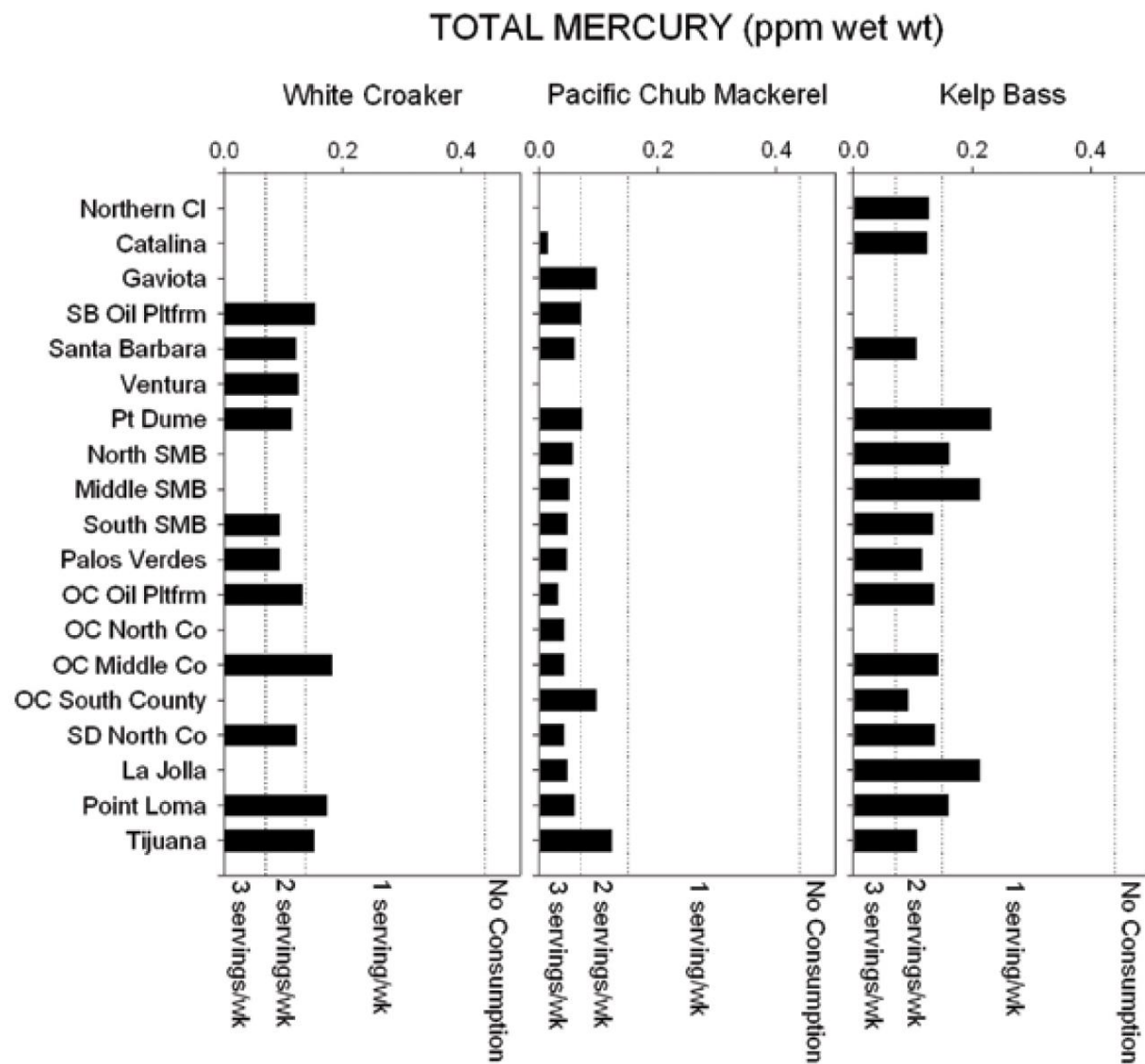


Figure 4-3. Average methylmercury concentrations (ppm) by fishing zone for three commonly occurring species in the Southern California Bight.

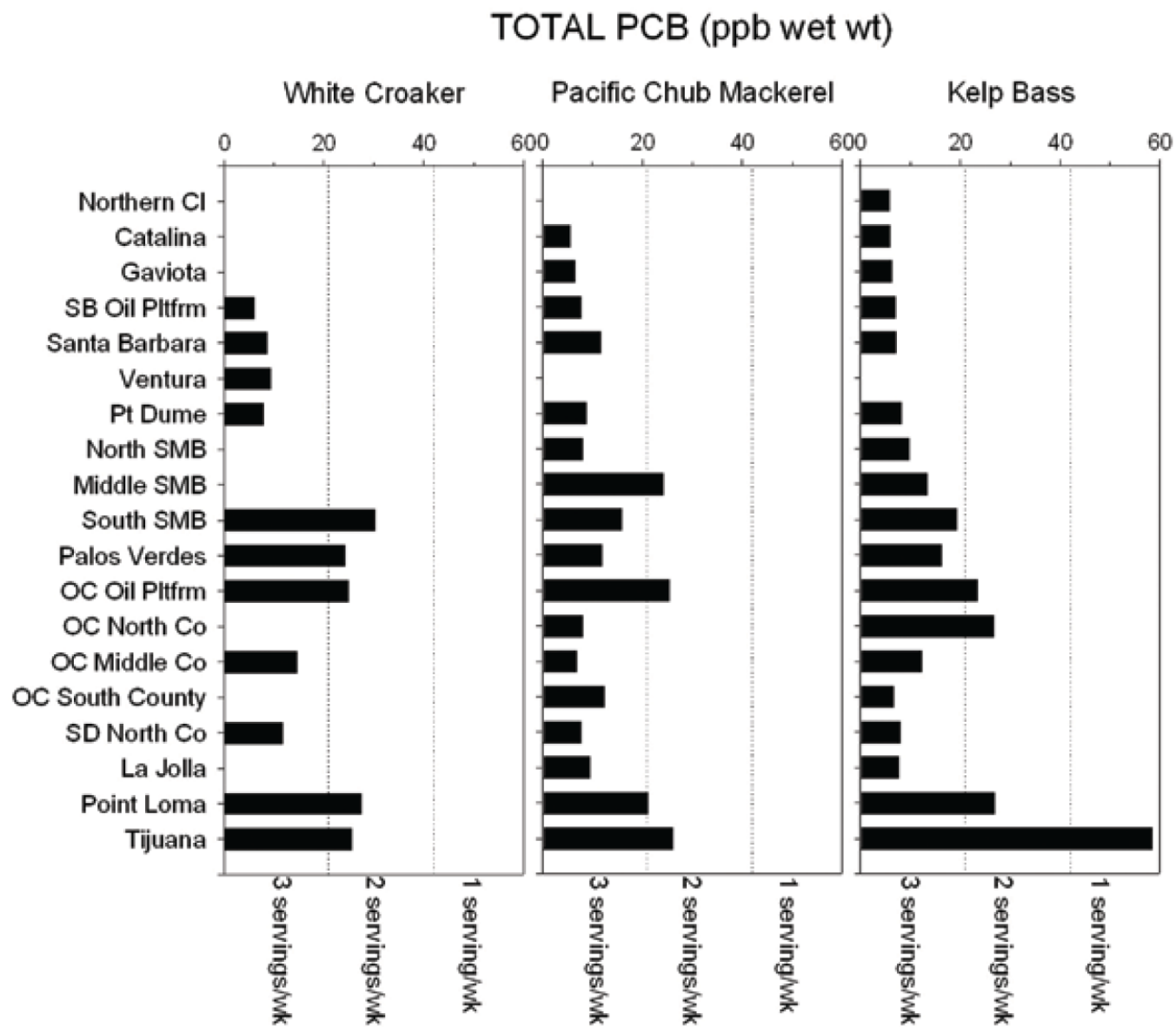
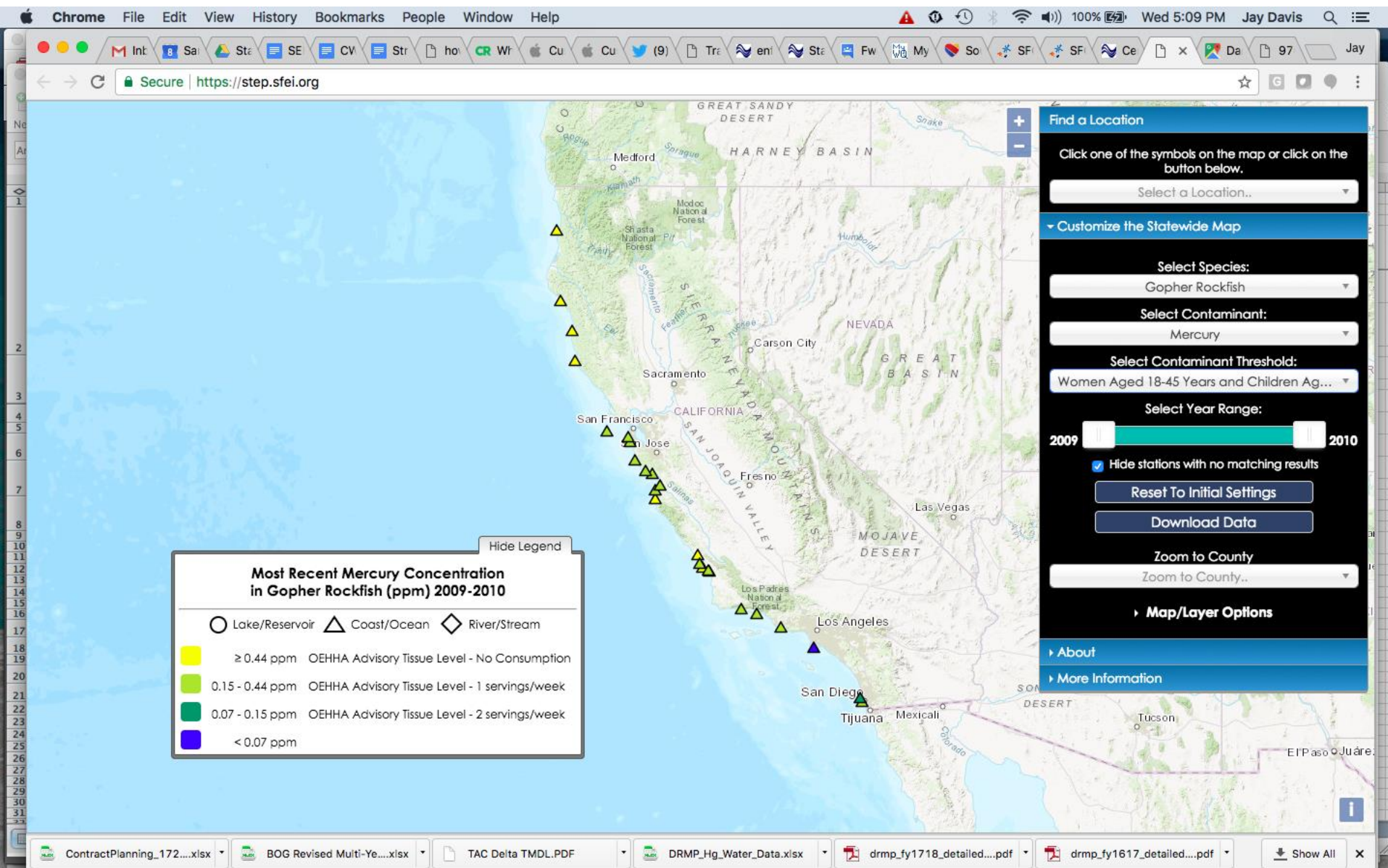


Figure 4-5. Average PCBs (ppb) by fishing zone for three commonly occurring species in the Southern California Bight.

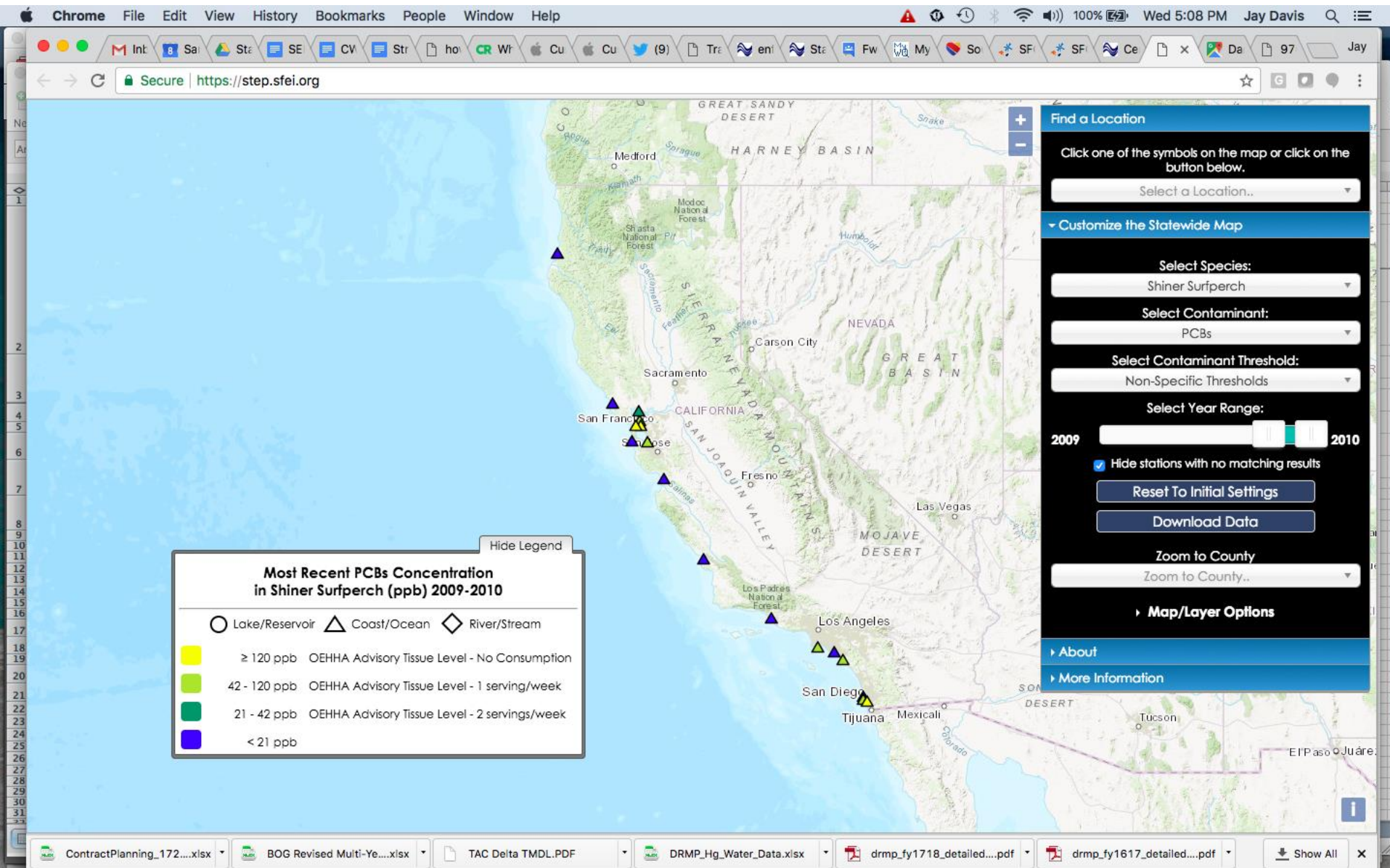
Details and Decisions: Species

- **BOG preferences**
- Mercury trend indicator species (analyze individual fish)
 - Kelp Bass
 - Barred Sand Bass
 - Spotted Sand Bass
 - Gopher Rockfish - statewide indicator (not on Bight list)
- Organics trend indicator species
 - Shiner Surfperch - statewide indicator
- Region 4 augment targets
 - Sharks and Rays
 - Surfperch

BOG Statewide Indicator: Gopher Rockfish



BOG Statewide Indicator: Shiner Surfperch



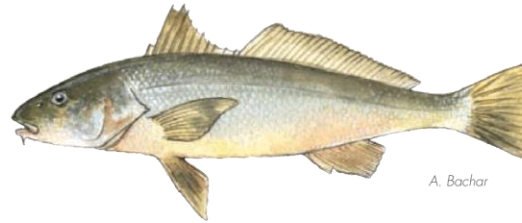


COMMONLY CAUGHT SOUTHERN CALIFORNIA SURF SPECIES



A. Bachar

Barred surfperch
Amphistichus argenteus



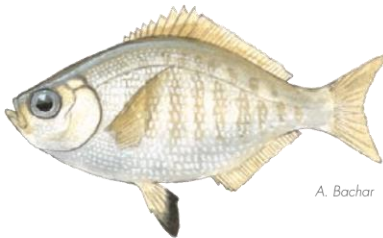
A. Bachar

California corbina
Menticirrhus undulatus



A. Bachar

Leopard shark
Triakis semifasciata



A. Bachar

Walleye surfperch
Hyperprosopon argenteum



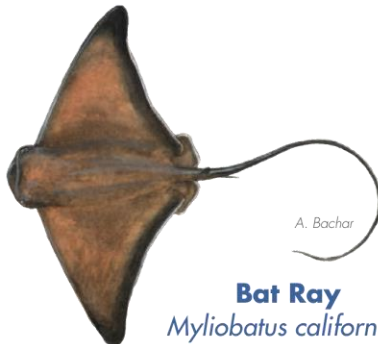
A. Bachar

Spotfin croaker
Roncador stearnsii



A. Bachar

California halibut
Paralichthys californicus



A. Bachar

Bat Ray
Myliobatus californica



A. Bachar

Yellowfin croaker
Umbrina roncadore



A. Bachar

Shovelnose guitarfish
Rhinobatos productus

For fish consumption advisories visit www.oehha.ca.gov/fish.html

For more information and current fishing regulations, visit the California Department of Fish and Game Web site at: www.dfg.ca.gov/marine.

Details and Decisions: Species

OEHHA Data Gaps

✓ We have collected these before and can target them

OEHHA Recommendations for Species Collection

SPECIES	CEDEN SAMPLES (Sites)	DESIRED SAMPLES*	NOTES
<i>Finfish</i>			
California Halibut** ✓	7(3)	23 individuals	Preferably from outside of bays and Social advisory area (Ventura Pier to Dana Point)
California Sheephead ?	8(2)	22 individuals from 2 locations	Need samples from spots other than Pt Loma and La Jolla kelp beds
Halfmoon** ?	4(1)	26 individuals from 2 locations	Halfmoon and Opaleye can be grouped together, so a combined total of 30 is acceptable
Opaleye** ✓	20(4)	10 more individuals	
Kelp Greenling ✓	23(6)	7 individuals	
Pacific Halibut ?	0	30 individuals from 3 locations	
Sharks (Shortfin Mako, Blue Shark, Thresher) ✗	0	30 individuals from 3 locations	
Tuna species (Albacore, Bluefin, Yellowfin, Bigeye) ✗	0	30 individuals from 3 locations	
<i>Invertebrates</i>			
Rock Crab (Brown, Yellow)** ?	6(1)-Ventura Pier, 15(1)-Santa Monica	9 individuals from 1 location	We have enough Red Rock Crab
Spiny lobster ?	0	30 individuals from 3 locations	
Pismo Clams ?	0	30 individuals from 3 locations	
Littleneck Clams ?	5 from Humboldt (40.7685, -124.236)	25 individuals from 3 locations	

Design Within Each zone

- Replication (within-zone variance estimates)
 - 3 reps/zone in SC Bight, SF Bay
 - Otherwise no reps in Central and North
 - Focus on covering more species
 - Better info for OEHHA, public
 - Better spatial coverage and comparisons

Design Within Each Zone (continued)

- Focus on areas within zone with highest fishing pressure
- Opportunistic approach - obtain fish from easiest areas to get them

Sample Processing and Analysis

- Ancillary data
 - Total length, fork length, weight, sex
 - Location coordinates to store in database: start of a trawl, fishing, gill net or dive
 - Field observations: dominant substrate, Beaufort scale, wind direction, bycatch
- Data sheets - need to get them into SWAMP
- MLML does all dissections
- Skin-off fillets
- Exceptions
 - E.g., shiner surfperch [muscle+skin+skeleton]

Analytes in Tissue

- Mercury (MLML, Bight): generally composites, some individuals
 - Individuals in mercury indicator species
- Selenium (MLML, Bight)
- PCBs (Bight, RMP, SWAMP): Bight congeners + SQO congeners
- DDTs (Bight): sum of six isomers
- Dieldrin (Bight)
- Chlordanes (Bight): sum of 5 compounds

PCB Congener Lists

Congeners	Bight	CASQO	SWAMP	BOG	analyzed by EPA	BOG	Bight	CASQO	SWAMP	BOG	analyzed by EPA	BOG
			5				126			126		
		8	8	8			128	128	128	128		
			15						137	137		
	18	18	18	18			138	138	138	138		
			27	27					141	141		
	28	28	28	28						146		
			29	29			149		149	149		
			31	31			151		151	151		
			33	33			153	153	153	153		
	37						156		156	156		
	44	44	44	44			157		157	157		
	49		49	49			158		158	158		
	52	52	52	52			167					
			56	56			168					
			60	60			169			169		
				64			170		170	170		
	66	66	66	66					174			
	70		70	70			177		177	177		
	74		74	74			180	180	180	180		
	77			77			183		183	183		
	81						187	187	187	187		
	87		87	87			189		189	189		
			95	95			194		194	194		
			97	97				195	195	195		
	99		99	99						198/199		
	101	101	101	101					200	200		
	105	105	105	105			201		201	201		
	110	110	110	110					203	203		
	114		114	114			206		206	206		
	118	118	118	118					209	209		
					Total Number		39	16	50	53		

Analytes in Tissue (continued)

- Ancillary parameters: lipid, moisture
- Arsenic (total) - Bight
- Bioanalytical screening - Bight
- PBDEs - SF Bay
- PFASs - SF Bay
- Dioxins - SF Bay
- Microplastic - SF Bay

QA

- Intercalibration
 - Separate Powerpoint by Ken
 - Labs: Bight labs, MLML, SWAMP lab, RMP labs (Axys, MLML)
- QAPP
 - Bight
 - SWAMP
- Data validation and QA review
 - Bight
 - SWAMP
 - Congener profile review

Sampling Methods

- Trawling
- Seining
- Spearfishing
- Hook and line
- Gill and cast nets

Target Size Ranges and Compositing for Each Species

- Composite to stretch dollars
- Use 75% rule (Bight rule)
- Target middle of distribution that is caught and consumed
- Use ranges established in 2009-2010
- Numbers in composites
 - Generally 5
 - 20 for surfperch

Ancillary Water Quality Data

- None

Archiving

- Rationale
 - Insurance policy for usual analytes
 - Potential retrospective analysis of new analytes
 - E.g., microplastic, emerging contaminants, mercury isotopes
- Short-term archives
 - Standard duration of 5 years (MLML, Bight, RMP)
 - Keep some longer?
- Long-term archives
 - RMP - collaboration with NIST - liquid N - minus 150 deg C










Data Management

- Data will go into CEDEN
- Portal will draw from CEDEN

Assessment Thresholds

- Advisory Tissue Levels

From Klasing and Brodberg. Fish Contaminant Goals and Advisory Tissue Levels for Contaminants in Sport Fish June 2008 (Updated ATL Table November 2017)

TABLE 2. ADVISORY TISSUE LEVELS (ATLS) FOR SELECTED FISH CONTAMINANTS BASED ON CANCER OR NON-CANCER RISK USING AN 8 OUNCE SERVING SIZE (PRIOR TO COOKING) (PPB, WET WEIGHT)								
Contaminant	Consumption Frequency Categories (8-ounce servings/week) ^a and ATLS (in ppb)							
	7	6	5	4	3	2	1	0
Chlordanes ^c		>80-90	>90-110	>110-140	>140-190	>190-280	>280-560	>560
DDTs ^{**}		>220-260	>260-310	>310-390	>390-520	>520-1,000	>1,000-2,100	>2,100
Dieldrin ^c		>7-8	>8-9	>9-11	>11-15	>15-23	>23-46	>46
Mercury ^{nc} (Women 18-45 and children 1-17)		>31-36	>36-44	>44-55	>55-70	>70-150	>150-440	>440
Mercury ^{nc} (Women > 45 and men)		>94-109	>109-130	>130-160	>160-220	>220-440	>440-1,310	>1,310
PBDEs ^{nc}		>45-52	>52-63	>63-78	>78-100	>100-210	>210-630	>630
PCBs ^{nc}		>9-10	>10-13	>13-16	>16-21	>21-42	>42-120	>120
Selenium ^{nc}		>1,000-1200	>1,200-1,400	>1,400-1,800	>1,800-2,500	>2,500-4,900	>4,900-15,000	>15,000
Toxaphene ^c		>87-100	>100-120	>120-150	>150-200	>200-300	>300-610	>610

^cATLS are based on cancer risk

^{nc}ATLS are based on non-cancer risk

*Serving sizes are based on an average 160 pound person. Individuals weighing less than 160 pounds should eat proportionately smaller amounts (for example, individuals weighing 80 pounds should eat one 4-ounce serving a week when the table recommends eating one 8-ounce serving a week).

**ATLS for DDTs are based on non-cancer risk for two and three servings per week and cancer risk for one serving per week.

Extra Slides

San Diego Bay



Google Earth

Data USGS
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